

Appl. No. : **09/770,540**
Filed : **January 26, 2001**

LISTING OF THE CLAIMS

1. (Withdrawn) A method of forming a rugged metal structure comprising the steps of:
forming a rugged structure comprised of substantially silicon atoms; and
replacing silicon atoms in the rugged structure with metal atoms.
2. (Withdrawn) The method of Claim 1, wherein the step of forming a rugged structure comprises:
depositing an amorphous or polycrystalline silicon structure by chemical vapor deposition; and
annealing the silicon structure to form a silicon surface having a rugged surface morphology.
3. (Withdrawn) The method of Claim 1, wherein the step of replacing silicon atoms with metal atoms comprises exposing the rugged structure to a refractory metal-halide complex.
4. (Withdrawn) The method of Claim 3, wherein the refractory metal-halide complex comprises WF₆.
5. (Withdrawn) The method of Claim 4, further comprising the step of chemically oxidizing the rugged structure prior to exposing the rugged structure to the refractory metal-halide complex.
6. (Previously Presented) A process for fabricating a metal-insulator-metal capacitor on a semiconductor wafer comprising the steps of:
forming a silicon electrode structure on the semiconductor wafer;
making the silicon electrode structure rugged; and
after making the silicon electrode rugged, replacing the silicon in the rugged silicon electrode structure with a metal, thereby forming a rugged metal electrode.
7. (Previously Presented) The process of Claim 6, further comprising covering the rugged metal electrode with a dielectric layer having a high dielectric constant.
8. (Original) The process of Claim 7, further comprising covering the dielectric layer with a metal layer.
9. (Previously Presented) The process of Claim 6, wherein the step of replacing the silicon in the silicon electrode structure comprises forming a boundary layer on the silicon

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electrode structure, exposing the silicon electrode structure to a refractory metal-halide complex, and removing the boundary layer.

10. (Previously Presented) The process of Claim 9, wherein the boundary layer comprises a dielectric and the refractory metal-halide complex comprises WF₆.

11. (Original) The process of Claim 7, wherein the dielectric layer comprises a material selected from the group consisting of Ta₂O₅, BaTiO₃, SrTiO₃, Ba_xSr_{1-x}TiO₃, and PbZr_xTi_{1-x}O₃.

12. (Original) The process of Claim 8, wherein the metal layer comprises titanium.

13.-24. (Cancelled)

25. (Withdrawn) A method of forming an integrated circuit capacitor on a substrate, the method comprising:

forming a rugged silicon electrode structure on the substrate;

forming a metal electrode having a rugged surface on the substrate after forming the rugged silicon electrode by replacing silicon in the rugged silicon electrode structure with metal;

covering said rugged surface with a dielectric; and

covering said dielectric with a second electrode.

26. (Withdrawn) The method of Claim 25, wherein forming the metal electrode comprises providing a hemispherical grain silicon morphology.

27. (Withdrawn) The method of Claim 25, wherein forming the metal electrode comprises forming a rugged silicon layer and converting the silicon layer to metal.

28. (Withdrawn) The method of Claim 1, wherein the rugged structure of substantially silicon atoms comprises a hemispherically grained silicon structure.

29. (Previously Presented) The process of Claim 6, wherein making the silicon electrode structure rugged comprises seeding and annealing to form a hemispherically grained silicon layer.

30. (Previously Presented) The process of Claim 6, wherein the rugged silicon electrode structure comprises a hemispherical grain morphology.